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EXAMINER	
REPKO, JASON MICHAEL	
ART UNIT	**PAPER NUMBER**
2671	

DATE MAILED: 02/22/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)
	09/852,906	BORAC, SILVIU
	Examiner	Art Unit
	Jason M. Repko	2671

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-63* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,2,9,10,16,22,23,30,31,37,43,44,51,52 and 58* is/are rejected.

7)☒ Claim(s) *3-8,11-15,17-21,24-29,32-36,38-42,45-50,53-57 and 59-63* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *09 May 2001* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: _____.

DETAILED ACTION

Drawings

1. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they do not include the following reference sign(s) mentioned in the description on line 6 of page 7: 33(2). Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Specification

2. The lengthy specification has not been checked to the extent necessary to determine the presence of all possible minor errors. Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

Claim Objections

3. Claims 1, 22, and 43 are objected to because of the following informalities: Claims 1, 22, and 43 contain the grammatical error "one a subdivision-inverse filter methodology or a least-squares optimization methodology is to be used." The office suggests the language "one of…." Appropriate correction is required.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. **Claims 1, 2, 9, 10, 16, 22, 23, 30, 31, 37, 43, 44, 51, 52, and 58 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,266,062 to Rivera (herein referred to as "Rivera") in view of Michael Loundsbery, Tony D. DeRose, and Joe Warren "Multiresolution Analysis for Surfaces of Arbitrary Topological Type," January 1997, ACM Transactions on Graphics, Vol. 16, No. 1, p. 34-73 (herein referred to as "Loundsbery et al") and in further view of Applicant's Admitted Prior Art: Denis Zorin, Peter Schröder, Wim Sweldens, "Interactive Multiresolution Mesh Editing," August 1997, Proceedings of the 24th Annual Conference on Computer Graphics and Interactive Techniques, p. 259-268 (herein referred to as "Zorin et al").**

6. With regard to claim 22, Rivera et al discloses "a method of generating a coarse level mesh representation representing a surface, from a finer level mesh representation *(abstract: "The derefinement method, for each target vertex finding an associated set of neighbor vertices to be derefined; then eliminating each said vertex according an appropriate order such that the derefinement of said vertex allows to re-obtain a previous terminal edge whose bisection produced said vertex.")* including the steps of:

a. indicator value generator step of, for respective ones of the points in the finer level mesh representation, evaluating an indicator function to generate an indicator value

(lines 18-32 of column 13: " The preferred embodiment of the derefinement method of this invention uses an integer-valued <u>*indicator function*</u> *VE-IND (associated with the relation of precedence in the generation process between each vertex and its neighbors), such that, for each vertex VE, either (1) VE-IND is equal to zero whether VE is a vertex of the initial or improved mesh (not obtained by using the longest-edge refinement method of this invention), initialized in box 910 of FIG. 18... ")* to determine a position for a corresponding point in the coarse level mesh representation; and

b. a coarse level mesh generator step of determining, for each of the points that are to be provided in the coarse level mesh representation, a position in the coarse level mesh representation in response to the position of the corresponding point in the finer level mesh representation *(lines 24-28 of column 16: "Turning to FIG. 21, the derefinement method of this invention essentially comprises, for each target vertex VX to be derefined or eliminated (box 1200) of associated node (VX, NX, GX), where NX is the VE-IND value of VX and GX its generator edge (box 1220), ")*...”), in accordance with the outcome of the indicator function *(lines 37-40 of column 13: "The vertices whose VE-IND value is equal to 0 (and whose generator edge is equal to NULL) correspond to the initial mesh and cannot be derefined throughout the process. ")*.

7. The indicator function in Rivera is analogous to the indicator function of claim 1 in that it is used to identify vertices resulting from a subdivision method *(lines 23-25 of column 13: "...whether VE is a vertex of the initial or improved mesh (not obtained by using the longest-edge refinement method of this invention)... ")*. However, Rivera restricts the subdivision inverse step to meshes obtained from “longest-edge refinement,” and does not teach a “subdivision

inverse filter." Loundsbery et al discloses a "subdivision inverse filter" (*2^{nd} paragraph of section 6.3: "For any multiresolution analysis the synthesis filters are defined by the relation...and the analysis filters are obtained from the inverse relation..."*) to determine a position in the coarse level mesh representation in response to the position of the corresponding point in the finer level mesh representation (*3^{rd} paragraph of section 6.3: "The analysis filters can be used to decompose a surface $S^{j+1}(x)$ in $V^{j+1}(M^0)$ given by ... into a lower resolution part in $V_j(M^0)$ plus a detail part in $W_j(M^0)$."*).

8. Rivera and Loundsbery et al are analogous art because they are from a similar problem solving area: fine-to-coarse mesh generating methods. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to use the method disclosed by Loundsbery et al to generate a coarse level mesh in the system disclosed by Rivera. The motivation for doing so would have been to reverse the subdivision methods other than the "longest edge refinement," such as those disclosed by Loundsbery et al in Table I on page 57. Therefore, it would have been obvious to combine Rivera with Loundsbery et al to obtain the invention specified in claim 22.

9. However, neither Rivera nor Loundsbery et al disclose a "least squares optimization methodology." Rivera is unable to refine vertices that do not directly result from a subdivision method, as indicated by the indicator function (*lines 37-40 of column 13: "The vertices whose VE-IND value is equal to 0 (and whose generator edge is equal to NULL) correspond to the initial mesh and cannot be derefined throughout the process."*). Zorin et al discloses using a least squares methodology in a fine-to-coarse level mesh generating method (*2^{nd} paragraph of section 3: "In this section we describe analysis which goes from fine to coarse. We first need smoothing,*

i.e., a linear operation H to build a smooth coarse mesh at level i-1 from a fine mesh at level i...Least squares: One could define analysis to be optimal in the least squares sense...").

10. Rivera, Loundsbery et al and Zorin et al are analogous art because they are from a similar problem solving area: fine-to-coarse mesh generating methods. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to incorporate a least squares optimal method as disclosed by Zorin et al to refine the vertices that are indicated by the indicator function to correspond to the initial mesh (*lines 37-40 of column 13*) in the system disclosed by Rivera. The motivation for doing so would have been to generate a coarser mesh that would otherwise possible under the condition that only vertices that are the direct result of the subdivision can be derefined. Therefore, it would have been obvious to combine Zorin et al with Rivera and Loundsbery et al to obtain the invention specified in claim 22.

11. With regard to claim 23, Zorin et al further discloses "Laplacian generator step of generating a Laplacian value for said respective ones of the points in the finer level mesh representation" (*2^{nd} paragraph of section 3: "Use the average...to define the discrete Laplacian* $\boldsymbol{H} := (I + \mu\mathcal{L})(I+\lambda\mathcal{L})$; *$4^{th}$ paragraph of section 3: "As indicated in Fig. 7 the detail vectors are defined as* $d^i=(F^i)^t(s^i\text{-}Ss^{i-1})=(F^i)^t(I\text{-}S\boldsymbol{H})s^i$, *i.e. the detail vectors at level i record how much the points at level i differ from the result of subdividing the points at level i-1."*).

12. With regard to claims 30, 31, and 37, Zorin et al further discloses "the coarse level mesh generator step includes the step of determining, for at least one of the points that are to be provided in the coarse level mesh representation, the position in the coarse level mesh representation as the position of the corresponding point in the finer level mesh representation (*6^{th} paragraph of section 4: "Analysis computes points on the coarser level i-1 using smoothing*

(smooth), subdivides s^{i-1} (subd), and computes the detail vectors d^i (cf. Fig. 7). ") if the magnitude of the Laplacian value generated during the Laplacian generator step is below a predetermined threshold value" (*1st paragraph of section 4.1: "Adaptive analysis avoids the storage cost associated with detail vectors below some threshold ε_A by observing that small detail vectors imply that the finer level almost coincides with the subdivided coarser level. The storage savings are realized through tree pruning."; 2nd paragraph of section 4.1: "Triangles that do not contain details above the threshold are unrefined..."*).

13. With regard to claims 30, 31, and 37, Zorin et al does not chose between a subdivision inverse filter or least squares methodology when the detail vectors are below a given threshold. However, one of ordinary skill in the art would recognize the magnitude of the detail vector indicates which method would be more suitable from the statement in the 1st paragraph of section 4.1: "small detail vectors imply that the finer level almost coincides with the subdivided coarser level." At the time of the invention, it would have been obvious to a person of ordinary skill in the art to further modify the combination of Rivera, Loundsbery et al, and Zorin et al to use a Laplacian as disclosed by Zorin et al to generate a detail vector to be used to determine the type of coarse level generation step, and use the subdivision inverse filter in the instance the detail vector indicates the fine mesh is subdivided coarser level, and the least squares in the instance it does not. The motivation for doing so would have been to enable the indicator function of Rivera to determine finer levels coinciding with coarse levels for subdivision schemes other than those generated by "longest-edge refinement." Therefore, it would have been obvious to further modify the combination of Rivera, Loundsbery et al, and Zorin et al to obtain the invention specified in claims 23, 30, 31, and 37.

14. Claim 1 is rejected with the rationale of claim 22. Claim 1 is similar in scope to claim 22. Rivera shows a fine-to-coarse level mesh generating arrangement (*line 6 to column 14 through lines 4 of column 4: " The actualization of the longest-edge mesh data structure, either by point insertion (refinement) or by point elimination (derefinement) is locally performed by the parallel computers of FIG. 20 and FIG. 23 respectively which in turn modify the shared mesh data structure according the diagrams of FIGS. 19 and 24, respectively."*).

15. Claims 2, 9, 10, and 16 are rejected with the rationale of claims 23, 30, 31, and 37, respectively. Claims 2, 9, 10, and 16 are similar in scope to claims 23, 30, 31, and 37.

16. Claim 43 is rejected with the rationale of claim 22. Claim 43 is similar in scope to claim 22. The feature of a computer program product is inherent in the system disclosed by Rivera in Figure 20, as the system would be inoperable without a computer program product instructing the computer to manipulate the data structure in the manner defined by the method disclosed by Rivera.

17. Claims 44, 51, 52, and 58 are rejected with the rationale of claims 23, 30, 31, and 37, respectively. Claims 44, 51, 52, and 58 are similar in scope to claims 23, 30, 31, and 37.

Allowable Subject Matter

18. Claims 3-8, 11-15, 17-21, 24-29, 32-36, 38-42, 45-50, 53-57, and 59-63 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

19. The following is a statement of reasons for the indication of allowable subject matter: While the prior art of Rivera, Loundsbery et al, and Zorin et al show the limitations recited in the parent claims, the mathematical expressions claimed in 3-7, 11-15, 17-21, 24-28, 32-36, 38-42,

45-49, 53-57, and 59-63 are not shown nor are they obvious in view of the teachings of the prior art.

Conclusion

20. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. U.S. Patent No. 5,506,947 to Taubin et al discloses using a Gaussian kernel in a surface smoothing method. U.S. Patent No. 6,009,435 to Taubin et al discloses a multiresolution polygonal mesh.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jason M. Repko whose telephone number is 571-272-8624. The examiner can normally be reached on Monday through Friday 8:30 am -5:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ulka Chauhan can be reached on 571-272-7782. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

JMR

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SUPERVISORY PATENT EXAMINER